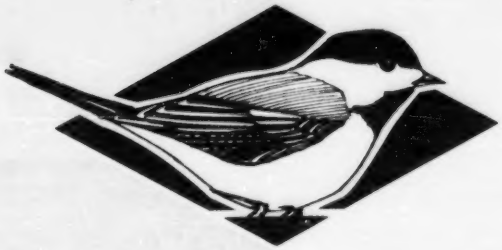

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Status of the Western Spiderwort (Tradescantia occidentalis) in Alberta

Bonnie Smith

Alberta Wildlife Status Report No. 31

Alberta
ENVIRONMENT

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PREFACE

Every five years, the Fisheries and Wildlife Management Division of Alberta Natural Resources Service reviews the status of wildlife species in Alberta. These overviews, which have been conducted in 1991 and 1996, assign individual species to 'colour' lists that reflect the perceived level of risk to populations that occur in the province. Such designations are determined from extensive consultations with professional and amateur biologists, and from a variety of readily available sources of population data. A primary objective of these reviews is to identify species that may be considered for more detailed status determinations.

The Alberta Wildlife Status Report Series is an extension of the 1996 Status of Alberta Wildlife review process, and provides comprehensive current summaries of the biological status of selected wildlife species in Alberta. Priority is given to species that are potentially at risk in the province (Red or Blue listed), that are of uncertain status (Status Undetermined), or which are considered to be at risk at a national level by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Reports in this series are published and distributed by the Alberta Conservation Association and the Fisheries and Wildlife Management Division of Alberta Environmental Protection, and are intended to provide detailed and up-to-date information which will be useful to resource professionals for managing populations of species and their habitats in the province. The reports are also designed to provide current information which will assist the Alberta Endangered Species Conservation Committee to identify species that may be formally designated as endangered or threatened under the Alberta Wildlife Act. To achieve these goals, the reports have been authored and/or reviewed by individuals with unique local expertise in the biology and management of each species.

EXECUTIVE SUMMARY

Western spiderwort (Tradescantia occidentalis (Britt.) Smyth) is distributed in the central United States but only enters Canada at four points along the far southern Canada/United States border. The species has only recently been discovered (1986) in Alberta. Western spiderwort is currently designated as 'threatened' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2000). This report summarizes existing information on western spiderwort in Alberta as a step in assessing its status in the province.

Western spiderwort is associated with partially stabilized or active sand dunes. In Alberta, the species is restricted to one location in the Dry Mixedgrass Subregion of the Grassland Natural Region - an area that has undergone extensive modification from human activity. The population at one additional Alberta location has never been confirmed.

The current population of western spiderwort fluctuates considerably from year-to-year based, most likely, on spring moisture levels. Populations vary from 27 to 210 stems. In 1999, only 27 stems were counted. The most significant factor affecting population stability is habitat loss from dune stabilization. Considerable work on management strategies and population assessment should be undertaken as soon as possible to maintain the presence of this species in Alberta.

ACKNOWLEDGEMENTS

The assistance of several people in the writing of this report is gratefully acknowledged: Joyce Gould and Patsy Cotterill (both, Alberta Natural Heritage Information Centre) for recent population and site information on western spiderwort, Sherry Hohn and Robert Parsons for their 1992 report on a Manitoba population survey for western spiderwort, Sherry Hohn, again, for her 1994 report on habitat requirements and Management Implications for Western Spiderwort, Bob Godwin and Jeff Thorpe for their 1991 Addendum to Status Report on Western Spiderwort, Clifford Wallis for his work on sandy areas of Alberta and rare plant species and Glennis Lewis for her field assistance during the author's original survey.

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INTRODUCTION

Western spiderwort (Tradescantia occidentalis (Britt.) Smyth) is the only species of Tradescantia native to Alberta. It is widely distributed in the central United States but enters Canada at only four locations: one in Alberta; one disjunct site in Saskatchewan; and two sites in Manitoba. In Alberta, western spiderwort occurs along the old dune fields east of Pakowki Lake and is restricted to the Dry Mixedgrass Subregion - an area extensively modified by agriculture with few native tracts remaining (Alberta Environmental Protection 1997). The species is ranked S1* by the Alberta Natural Heritage Information Centre because of the paucity of occurrences in the province (ANHIC 2000). Western spiderwort is designated as 'threatened' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2000).

This report summarizes current and historical information on western spiderwort in Alberta in order to assess the status of the species in the province.

The use of common names in the text follows Alberta Environmental Protection (1993).

HABITAT

Western spiderwort is restricted to sand dune areas and appears to require some element of active (drifting) sand. In Alberta, the single known location where western spiderwort occurs is in one small area of the Pakowki Lake sand hills in the southeastern portion of the province. There, the species is restricted to partially stabilized sand in dune slack areas and active sand on the dune area northeast of Pakowki Lake (Wallis and Wershler 1988). The sites where western spiderwort occurs are in sparsely vegetated and somewhat depressed areas among dunes. Slip faces of dunes immediately to the south and north of the site and a dune with choke cherry (Prunus virginiana) thickets to the west provide some shelter but sand gets deposited during windy days (Hrapko 1989). The major active sandy areas that the western spiderwort and other rare, threatened, and endangered species of plants and animals depend on have been almost completely cultivated (Wallis 1988).

In Alberta, western spiderwort is restricted to the Dry Mixedgrass Subregion of the Grassland Natural Region (Alberta Environmental Protection 1997). The climate in the Dry Mixedgrass Subregion is the warmest and driest in Alberta. This subregion has a typical continental climate with cold winters, warm summers and low precipitation. Because of the warm summer temperatures and high average wind speed, the rate of evaporation is high throughout the summer months (Alberta Environmental Protection 1997).

The single known occurence in Saskatchewan occurs on sand hills east of Lake Diefenbaker. The site is on the mid and upper slope of stabilized southwesterly facing slopes covering an area of 150 m to a side. A second nearby site is in the lower slope position of an active blowout (Godwin and Thorpe 1991).

The principal vegetation composition of western spiderwort sites appears to be typified by drought resistant grasses such as blue grama (Bouteloua gracilis) and needle-and-thread grass (Stipa comata); Coupland 1987). Sand dunes exhibit a range of habitats from active dunes to stabilized sites with needle-and-thread grass and sand grass (Calamovilfa longifolia); a variety of low shrubs, primarily buckbrush (Symphoricarpos occidentalis) and prickly rose (Rosa acicularis); tall shrubs, mainly choke cherry (Prunus virginiana), and silverberry (Elaeagnus commutata), and trees, including

* See Appendix 1 for definitions of selected status designations

clones of aspen (Populus tremuloides) and scattered plains cottonwoods (Populus deltoides). Hrapko (1989) listed the dominant associated plants at the Pakowki Lake location as follows: june grass (Koeleria macrantha), prairie rose (Rosa arkansana), prairie selaginella (Selaginella densa) and prairie sagewort (Artemisia ludoviciana). Wallis and Wershler (1988) stated that western spiderwort occurs where there is 70% or more bare sand in an Indian rice grass (Oryzopsis hymenoides) and sand grass community associated with species such as plains wormwood (Artemisia campestris), Rosa spp., Helianthus spp., Corispermum spp., bur ragweed (Franseria acanthicarpa) and golden aster (Heterotheca villosa). Other associated species include cushion cactus (Corypantha vivipara), brittle prickly-pear (Opuntia fragilis), golden bean (Thermopsis rhombifolia) and scattered chokecherry (Prunus virginiana).

CONSERVATION BIOLOGY

The western spiderwort is an erect perennial with slender stems. The leaves are linear, with conspicuously ribbed, curved sheaths, swollen at the juncture with the node. The roots are stout and fleshy with slender fibrous rootlets. The flowers are in terminal cymes[1]. Pedicels and sepals are glandular and pubescent[2]. Petals are 10-15 mm long, rose to dark blue in colour, arranged in threes, slightly pointed at the tips. Flower colour may be blue or more infrequently pink. There are six stamens, hairy, with bright yellow anthers. Capsules are obovoid or oblong in shape, puberulent[3] at the apex, 5-10 mm long, each containing 2-6 pitted compressed seeds. Western spiderwort normally flowers from May to July (shorter and later in northern climates; late June and early July in Alberta). Each flower lasts only one day. The plant reproduces through seeds and by vegetative propagation (Hohn 1994).

Western spiderwort is very dependent on moisture levels. In Alberta, flowering occurs mostly in July. In 1986, the plants were found in bud on June 11, with mature fruit on July 19 and in 1987, the plants were in full flower on July 5. In 1990, a year with greater than normal moisture, the plants were in flower on June 21 (Smith and Bradley 1990). In 1999, the plants were still in bud by June 29 (J. Gould and P. Cotterill, unpubl. data).

Tradescantia is sometimes called spiderwort because of the soft, stringy, mucilaginous material which can be pulled from the broken ends of the stem. This material will harden into a cobweb-like thread after exposure to the air (Jones and Luchsinger 1986). There are no other indigenous species of plants with which to confuse western spiderwort in its natural habitat in southeastern Alberta. The only other species of Tradescantia native to Canada is T. ohiensis Raf., which is restricted to southwestern Ontario.

Western spiderwort is known to hybridize with Tradescantia canaliculata, a southern United States species (Anderson and Hubricht 1938). Hybrids formed with T. ohiensis have also been noted in the eastern United States (Legeay 1968). One of the main barriers between closely related species of the genus Tradescantia is differences in habitat preferences. Changes to natural ecological conditions resulting from human activities such as construction of roads, railways and ditches increase the likelihood of introgressive hybridization (Anderson and Hubricht 1938). However, hybridization in nature is highly unlikely in Canada because of the large geographic separation of the two Canadian species.

[1] More or less flat-topped cluster of flowers in which the central or terminal flower opens first.
[2] Covered with hairs, especially if short, soft and down-like.
[3] Minutely pubescent

DISTRIBUTION

1. Alberta. - Western spiderwort was first discovered in Alberta in 1986 at one location in the southeast. In 1988, two additional colonies were found at the same location (Hrapko 1989) and in 1999, another two nearby sites were located (J. Gould and P. Cotterill, unpubl. data). All known western spiderwort sites in Alberta occur within one narrow region of the Pakowki Lake Sand Hills and consist of closely scattered small populations (Figure 1). No other locations have been found for this species despite ongoing surveys within the sandy areas of southern Alberta.

The origin of the apparent native occurrence discovered at Whiskey Gap (#2 on map) in 1989 is questionable as a result of identification problems because of its immature stage of development (J. D. Johnson, unpubl. data). This location has never been confirmed.

2. Other Areas. - Western spiderwort is widespread throughout the central United States. It occurs in Montana, North Dakota, South Dakota, Minnesota, Wisconsin, Nebraska, Wyoming, Utah, Colorado, Kansas, Arizona, New Mexico, Texas, Oklahoma, Arkansas, and Louisiana (Figure 2). In Canada, western spiderwort occurs in Alberta, Saskatchewan and Manitoba. Canadian populations are sporadic representing disjunct populations in Alberta (one location, southeastern Alberta; see Figure 1), Saskatchewan (one location, south central Saskatchewan), and Manitoba (two locations, southwestern Manitoba).

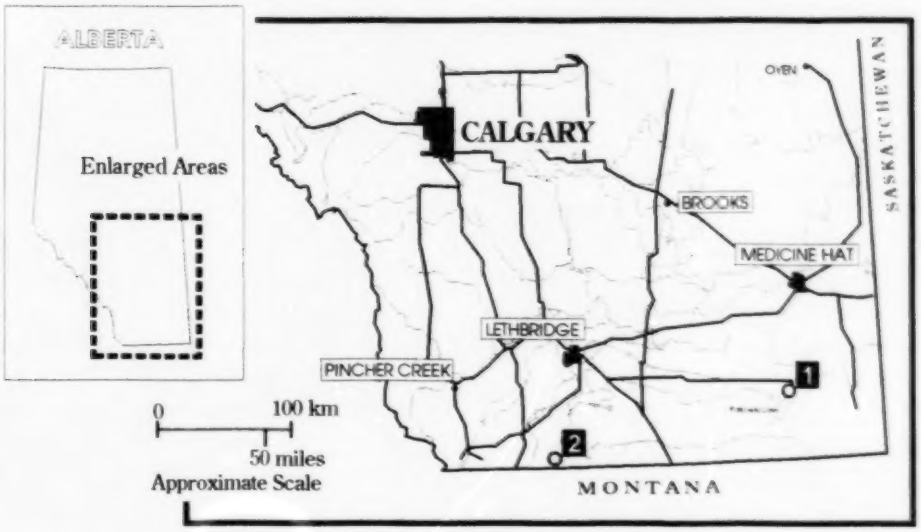

Figure 1. Locations of western spiderwort in Alberta. Numbers correspond to details of locations in Appendix 2. Location #2 has not been confirmed (see above).

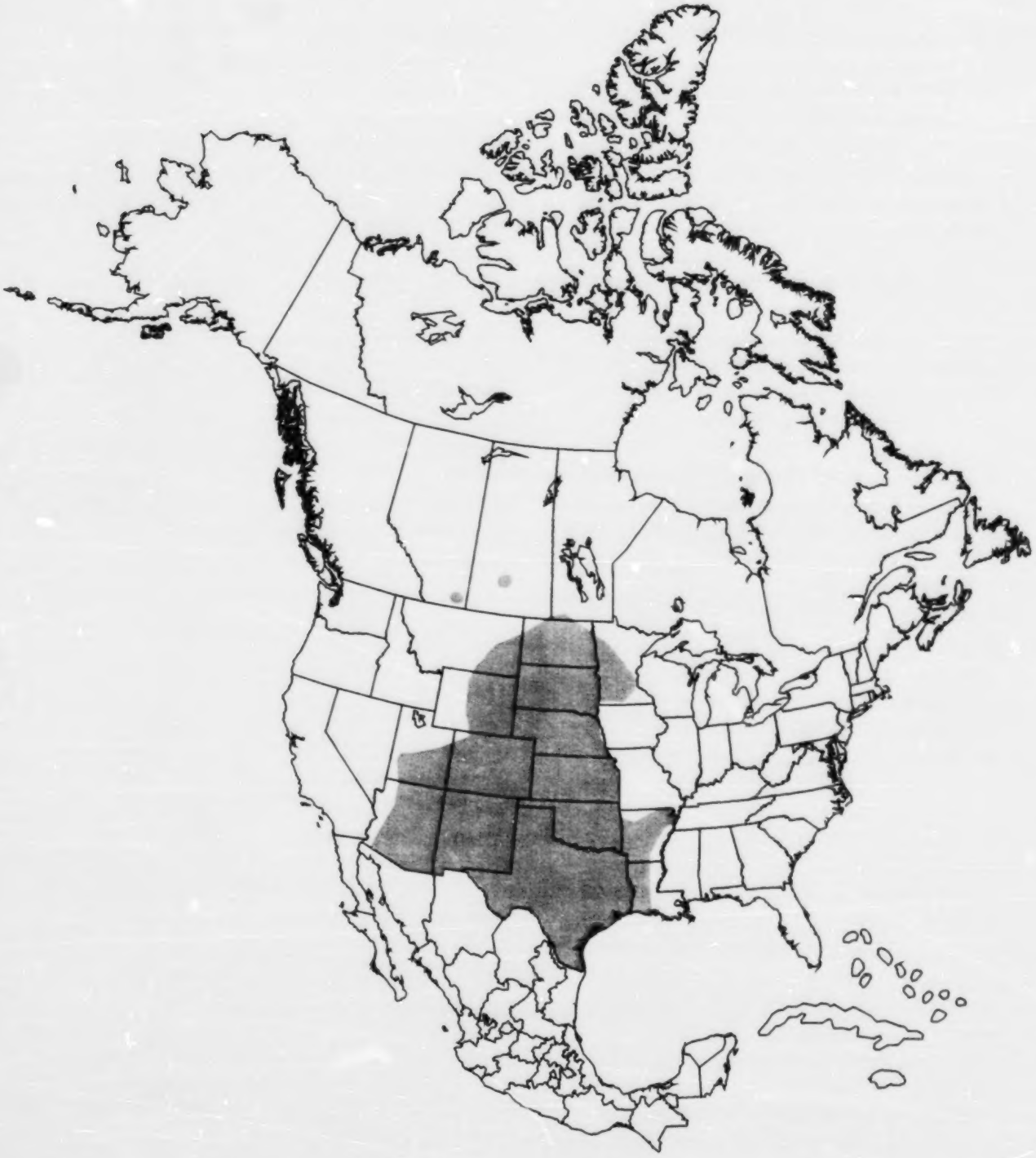

Figure 2. Distribution of western spiderwort in North America.

POPULATION SIZE AND TRENDS

1. Alberta. - The total Alberta population of western spiderwort can vary considerably from year-to-year depending on moisture levels (Wallis and Wershler 1988, Hrapko 1989, Smith and Bradley 1990, J. Gould and P. Cotterill, unpubl. data). In 1990, a very wet year, 210 individual plants bearing 1-6 stems per plant (2 stems on average) were counted (Smith and Bradley 1990). In comparison, in 1999, a much drier year, a total of 27 plants were found (J. Gould and P. Cotterill unpubl. data). Fifty plants were counted in 1986, whereas drier conditions in 1987 resulted in a total of 30 plants (Hrapko 1989).

2. Other Areas. - In Saskatchewan in 1991, 40 plants were found at the main site near Lake Diefenbaker and two plants were counted at a second nearby site (Godwin and Thorpe 1991).

Two western spiderwort locations occur in Manitoba. Populations at the two southwestern Manitoba sites have been intensively surveyed in three separate years.

The first Manitoba location is a Manitoba Habitat Corporation Property where three sites occur along a ridge of high sand hills (Hohn and Parsons 1992). In 1990, a total of 66 plants (1-4 stems per plant) were counted and in 1992, 380 plants (averaging 2.8 stems/plant and13.2 flowers/stem) were counted. Numbers remained similar in 1994 with little variation (Hohn 1994).

The Routledge Sand Hills location in Manitoba represents the largest western spiderwort population in Canada. In 1990, a total of 1578 plants (1-6 stems per plant, averaging two stems per plant) were counted. An additional 1650 to 1700 plants were estimated for a 3 km stretch along a major dune ridge. In 1992, a series (3 chains totaling 3 km) of sand dune ridges were surveyed resulting in a count of 7848 plants (average of 2.16 stems/plant). An additional 700 plants were counted on an area of crown land immediately adjacent to this private property holding. Increased precipitation since 1990 is likely responsible for the increased number of plants (Hohn and Parsons 1992). In 1994, numbers remained consistent reflecting 1992 totals (Hohn 1994).

LIMITING FACTORS

The main limiting factors for western spiderwort relate to loss or alteration of its preferred habitat- destabilized sites within dune fields. The Grasslands Natural Region is one of the most threatened natural regions in Alberta and many sand plains have been destroyed by human development (Wallis 1988). In Alberta, about 20% of the rare plants in the grassland and parkland regions are found in sandy soils principally in sand hill areas.

1. Conversion of Tame Pasture and Cropland.- More than two-thirds of the Mixed Prairie Grassland has been destroyed by cultivation (Wallis 1987). The proportion of farmland occupied by rangeland declined from 53% to 41% between 1956 and 1981 in Alberta (Mixed Prairie Census Districts). The area of uncultivated grasslands in Saskatchewan and Alberta is declining at a rapid rate. As time goes by, the surviving untilled area contains a smaller proportion of typical grassland and a large proportion of azonal types (saline flats, sloughs, sandhills, badlands). This is because the typical upland areas are being converted to cropland (Coupland 1987).

2. Dune Stabilization. - Although the exact mechanisms are unclear, dune stabilization has been noted at several dune fields in Alberta since 1950 (Wallis 1988). The active sand surface of some dunes in the Pakowki Lake area has been reduced by 50% to 75% (Wallis 1988). Continual stabilization of the dunes at Pakowki Lake would likely be detrimental to

the long-term survival of western spiderwort (Wallis and Wershler 1988).

3. Grazing and Fire Control. - While the dynamics of dune destabilization are poorly understood, experts generally agree that a combination of fire and grazing keeps blowouts active. Dunes have been stabilizing in the Middle Sand Hills where there have been repeated fires but little grazing and in other areas where there has been grazing but few fires (Wallis 1988). The Pakowki Lake site is leased for grazing but the condition of remaining Mixed Grassland is deteriorating because of increased grazing (Coupland 1987). This presents a management dilemma. The positive or negative impacts of grazing at various times of the year are unknown (Wallis and Wershler 1988). A current theory is that late summer or fall fires formerly created lush green areas the following spring. These green patches attracted large herds of grazing animals like bison and resulted in reactivation of the sand dunes. The sand hills were also apparently used as sheltering areas by bison during the winter and this could have been significant in keeping dunes active. Fire control and changes in grazing patterns have completely changed the factors that shape sand dune environments (Wallis 1988).

4. Invasive Weeds. - All western spiderwort locations in Canada, except Alberta, are experiencing habitat loss from the invasion of leafy spurge (Euphorbia esula; Smith and Bradley 1990). The small population at the Alberta location is particularly susceptible to destruction as a result of weed introduction. The Alberta site is currently free of leafy spurge but the site should be closely monitored.

5. Petroleum Exploration and Extraction. - Any attempt to develop oil resources or pipeline right-of-ways in the area northeast of Pakowki Lake could eradicate the species in Alberta. This would, of course, be true for any development project on or near the site.

STATUS DESIGNATIONS

1. Alberta. - In 1986, Hrapko (unpubl. data) and Wallis and Wershler (1988) identified western spiderwort as a 'potentially endangered species' in Alberta. Plants are covered by the Alberta Wildlife Act, however, no status designations for plants have yet been assigned under this Act. The Alberta Natural Heritage Information Centre (ANHIC) ranks western spiderwort as S1 (ANHIC 2000; see Appendix 1 for explanations of ranks).

2. Other Areas. - The western spiderwort has been listed as 'threatened' by the Committee on the Status of Endangered Wildlife in Canada since 1990 (COSEWIC 2000). The designation was based on the number of existing sites, the size of the populations and the dependence of the plant on variable climatic conditions. The species is listed as 'threatened' in Saskatchewan and Manitoba. White and Johnson (1980) identified western spiderwort as 'rare' in Manitoba. Harms et al. (1992) recommended a provincial status designation of 'endangered' in Saskatchewan.

Western spiderwort is listed in Rare Vascular Plants in Canada (Argus and Pryer 1990). The national rank assigned is N1 (meaning an element with 5 or fewer occurrences in Canada) with a Canadian priority of 3 (Argus and Pryer 1990). According to The Nature Conservancy's Natural Heritage Rarity Rank criteria, western spiderwort is ranked as G5 throughout its global range and has a sub-national rank of S1 in Alberta, Saskatchewan and Manitoba (The Nature Conservancy 2000).

Western spiderwort is not considered to be rare in any American state in which it occurs, and in many states is considered common (Ayensu and DeFilipps 1978).

RECENT MANAGEMENT IN ALBERTA

There are currently no management initiatives specifically for the western spiderwort in Alberta.

SYNTHESIS

Although western spiderwort has only been recently discovered in Alberta, annual fluctuations in population and potential habitat loss have increased concern for its continued existence in the province. Despite ongoing surveys of potential habitat, no other occurrences have been found in Alberta. Further surveys should be undertaken. The Alberta and Saskatchewan populations are very susceptible to site disturbance because of their small size and restricted distributions.

Detailed studies of the population dynamics and genetics of western spiderwort are needed to facilitate management for conservation by better identifying the number of individual plants, critical life stages and associated pollination vectors. Effective management of western spiderwort is also dependent on research into the effects of habitat fragmentation, grazing, and climatic factors. The Alberta population of western spiderwort is the only Canadian population currently unaffected by habitat loss from leafy spurge invasion. Because of this, it could be used as a control site in monitoring the progress of efforts in Manitoba to counteract the problem.

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APPENDIX 1. Definitions of selected legal and protective designations.

A. Status of Alberta Wildlife colour lists (after Alberta Wildlife Management Division 1996)

Red	Current knowledge suggests that these species are at risk. These species have declined, or are in immediate danger of declining, to a nonviable population size.
Blue	Current knowledge suggests that these species may be at risk. These species have undergone non-cyclical declines in population or habitat, or reductions in provincial distribution.
Yellow	Species that are not currently at risk, but may require special management to address concerns related to naturally low populations, limited provincial distributions, or demographic/life history features that make them vulnerable to human-related changes in the environment.
Green	Species not considered to be at risk. Populations are stable and key habitats are generally secure.
Undetermined	Species not known to be at risk, but insufficient information is available to determine status.

B. Alberta Wildlife Act

Species designated as 'endangered' under the Alberta Wildlife Act include those defined as 'endangered' or 'threatened' by *A Policy for the Management of Threatened Wildlife in Alberta* (Alberta Fish and Wildlife 1985):

Endangered	A species whose present existence in Alberta is in danger of extinction within the next decade.
Threatened	A species that is likely to become endangered if the factors causing its vulnerability are not reversed.

C. Committee on the Status of Endangered Wildlife in Canada (after COSEWIC 2000)

Extinct	A wildlife species that no longer exists.
Extirpated	A wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.
Endangered	A wildlife species that is facing imminent extirpation or extinction.
Threatened	A wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
Special Concern (Vulnerable)	A wildlife species of special concern because it is particularly sensitive to human activities or natural events, but does not include an extirpated, endangered or threatened species.
Not at Risk	A wildlife species that has been evaluated and found to be not at risk.
Indeterminate	A species for which there is insufficient scientific information to support status designations.

D. United States Endangered Species Act (after National Research Council 1995)

Endangered	Any species which is in danger of extinction throughout all or a significant portion of its range.
Threatened	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

E. Natural Heritage Element Rarity Ranks (after The Nature Conservancy 2000)

G1 / S1	**Critically Imperiled**: Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically 5 or fewer occurrences or very few remaining individuals (<1,000) or acres (<2,000) or linear miles (<10).
G2 / S2	**Imperiled**: Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction or elimination. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000) or acres (2,000 to 10,000) or linear miles (10 to 50).
G3 / S3	**Vulnerable**: Vulnerable globally either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction or elimination. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.
G4 / S4	**Apparently Secure**: Uncommon but not rare (although it may be rare in parts of its range, particularly on the periphery), and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long-term concern. Typically more than 100 occurrences and more than 10,000 individuals.
G5 / S5	**Secure**: Common, widespread, and abundant (although it may be rare in parts of its range, particularly on the periphery). Not vulnerable in most of its range. Typically with considerably more than 100 occurrences and more than 10,000 individuals.

B - A rank modifier indicating breeding status for a migratory species.
N - A rank modifier indicating non-breeding status of a migratory species.

APPENDIX 2. Confirmed and unconfirmed collections of western spiderwort in Alberta

Confirmed Collections	1A	Pakowki Lake Sand Hills, a dune area north to northeast of Pakowki Lake and about 13 km west of Manyberries; Julie O. Hrapko, 1986; Provincial Museum of Alberta.
	1B	Pakowki Lake Sand Hills, 14 fence posts west of the easternmost cottonwood tree along the east-west fence line of Pakowki Lake North Dune G and south of the fence line a short distance (5-8 m); Cliff Wallis, s.n.; July 5, 1987. (Other occurrences are east of the cottonwood tree along the fence line in bare sand and west of the cottonwood tree and 15 m east of a patch of cottonwood and aspen, 7-8 m south of the fence line.)
	1C	Pakowki Lake Sand Hills, as above (No. 1), leeward side of partly stabilized dune; Bonnie Smith and Glennis Lewis; (Smith #775); June 21, 1990; UAC 49458.
Unconfirmed collections	2B	Sommerfeldt Ranch, 49°1'N, 13°01'W, Whiskey Gap; rough fescue grassland, 1280-1400 m elevation; J. D. Johnson; May 30, 1987; Canadian Forestry Service Herbarium (CAFB); verified by William J. Cody but too immature for positive identification.

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